

disc, and the great inclination and eccentricity of its orbit, may also be considered as a true asteroid.

Dr. Herschel concludes by observing, that the specific difference between planets and asteroids appears now, by the addition of a third individual of the latter species, to be more fully established; and that circumstance, he thinks, has added more to the ornament of our system, than the discovery of another planet could have done.

An Essay on the Cohesion of Fluids. By Thomas Young, M.D. For. Sec. R.S. Read December 20, 1804. [*Phil. Trans.* 1805, p. 65.]

Dr. Young's principal objects in this paper are to reduce the phenomena of the capillary action of fluids to the general law of an equable tension of their surfaces; to investigate the properties of the curves resulting from this law; to determine the magnitude of the apparent adhesion of solids to fluids, and the cohesion of moistened solids; and to show in what manner the law itself is probably derived from the fundamental properties of matter.

Dr. Young observes, that a fluid which is not capable of wetting a given solid, forms with it an angle of contact which is constant in all circumstances; that the curvature of the surface of a fluid, or the sum of the curvatures, where the curvature is double, is always proportional to the elevation or depression with respect to the general surface, and that the curve itself admits, in all cases, an approximate delineation by mechanical means, but is not always capable of being easily subjected to calculation. When, however, the curvature is simple, the direction of the surface, at any given height, admits a correct determination. Hence the elevation of a fluid in contact with a given surface, whether vertical, horizontal, or inclined, is deduced from its ascent between plates, or in a tube, of the same substance; and the result is shown to agree with experiments. Thus, taking $\frac{1}{16}$ th of an inch for the diameter of a tube, in which water rises to the height of an inch, it is inferred that the apparent adhesion of water, to a square inch of any horizontal surface capable of being wetted by it, must be $50\frac{1}{2}$ grains, which is only half a grain more than the result of Taylor's experiments. The adhesion of alcohol, and of sulphuric acid, as measured by Achard, are also found to agree with the ascent of those fluids in capillary tubes. Lord Charles Cavendish's table of the depression of mercury in barometer tubes, is compared with the same principles by means of diagrams constructed for each particular case; and the apparent adhesion of the surface of mercury to glass, as well as the depth of a portion of mercury spread on a plate of glass, is deduced from these measures, and is shown to agree with experiments. The observations of Morveau, on the attraction of the different metals to mercury, are also discussed; and some remarks are made on the magnitude of drops of various substances.

The hydrostatic actions of these elevations and depressions of fluids are such as to afford a ready explanation of the attractions

and repulsions of floating bodies : these attractions are found to vary ultimately in the inverse ratio of the squares of the distances ; and they appear to be the same as are found to cause an apparent cohesion between any moistened surfaces nearly in contact : the magnitude of this cohesion, as measured, in a particular case by Morveau, being found to agree with the calculation of the effect of capillary action.

The attraction of a drop of a fluid towards the line of contact of two plates of glass, which was found by Hawkesbee to vary nearly in the inverse ratio of the square of the distance of the plates, was supposed by Newton to indicate an immediate cohesive force, varying in the simple inverse ratio. But Dr. Young has shown that the fundamental law of the equable tension of the surface is sufficient to explain this phenomenon, and to remove the apparent irregularity in the laws of cohesive forces.

The equable tension of the surface is shown to be a consequence which may be mathematically deduced from the existence of a stable equilibrium between the forces of repulsion and of cohesion, which is a necessary condition of liquidity, as the repulsive force always varies more rapidly than the cohesive force. The mutual attractions of solids and fluids are then considered ; and Dr. Young agrees with Clairaut, although upon different grounds, in affirming that a fluid will be elevated when in contact with any solid of more than half its attractive density. The tension of the common surfaces of a solid and a fluid, or of two continuous fluids, is supposed to be proportional to the difference of the attractive densities ; and this supposition is confirmed by some observations, with which the paper is concluded, on the phenomena of oily substances floating on water.

Concerning the State in which the true Sap of Trees is deposited during Winter. In a Letter from Thomas Andrew Knight, Esq. to the Right Hon. Sir Joseph Banks, Bart. K.B. P.R.S. Read January 24, 1805. [Phil. Trans. 1805, p. 88.]

This paper may be considered as a continuation of Mr. Knight's former communications respecting the motion of the sap in trees. Du Hamel, and other subsequent naturalists, have shown that trees contain two kinds of sap ; and the chief purpose of Mr. Knight's paper is to prove that one of them (called by Du Hamel *suc propre*, and by Mr. Knight the true sap,) is generated in the leaf ; and that this fluid, in an inspissated state, or some concrete substance deposited by it, exists during the winter in the albumen, from which substance, dissolved in the ascending aqueous sap, is derived the matter which enters into the composition of the new leaves in the spring. To the above-mentioned deposition, Mr. Knight attributes the well-known superiority of winter-felled wood, which superiority has generally been supposed owing merely to the absence of the sap at that season.

Du Hamel has remarked, that trees perspire more when the leaves